Director skill sets*

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Abstract

Directors are not one-dimensional. We characterize their skill sets by exploiting Regulation S-K's 2009 requirement that U.S. firms must disclose the experience, qualifications, attributes, or skills that led the nominating committee to choose an individual as a director. We then examine how skills cluster on and across boards. Factor analysis indicates that the main dimension along which boards vary is in the diversity of skills of their directors. We find that firm performance increases when director skill sets exhibit more commonality.

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1. Introduction

In theory, boards are multi-dimensional. The optimal board combines monitoring and advisory roles to varying degrees (Hermalin and Weisbach, 2003; Adams and Ferreira, 2007). Less well understood is how individual director skills map into these roles. Do directors specialize as "advisors" or "monitors," or, like boards, do they combine roles? And how do directors' skills aggregate to the board level—are individual skills independent of each other or do they complement/substitute each other? The answers to these questions are important for understanding what boards do, why they are structured the way they are, and how they can be improved. But answering these questions is difficult. It requires a complete characterization of director skills and how they cluster at the board level. We provide such a characterization in this paper.

The 2009 amendment to Regulation S-K requires public U.S. firms to describe their reasons for nominating directors. According to this rule, firms have to disclose the skills they believe each director brings to the table. We exploit this rule to document the skills directors and boards have. We then examine whether some boards have skill sets that lead them to systematically outperform other boards.

Regulation S-K allows us to assign skills to directors that are hard to characterize based on their employment history alone. For example, J.C. Penney's 2010 proxy statement reports the employment experience of director R. Gerald Turner as follows:

> *President of Southern Methodist University since 1995; Chancellor of the University of Mississippi from 1984 to 1995; Co-Chairman, Knight Commission on Intercollegiate Athletics since 2005; Director of Kronos Worldwide, Inc., American Beacon Funds and the National Association of Independent Colleges and Universities.*

Mr. Turner does not seem to have direct industry experience that is relevant for J.C. Penney, a chain of American mid-range department stores. As his leadership experience lies outside the corporate sector, he also does not hold an organizational position that would

normally be classified as indicative of valuable executive or financial skills. Although Mr. Turner's background gives the impression that he can add value, it is not obvious how to classify his skills.

Regulation S-K's required descriptions of the reasons firms nominate directors are useful for classifying the skills of such directors. For example, J.C. Penney's reasons for nominating Mr. Turner highlight his academic, compensation, governance, and human resources / management skills:

> *Mr. Turner's extensive career in academia provides the Company with valuable insights and perspectives on communicating with younger customers and Associates. He also brings experience and skills in human resources and management. Mr. Turner's current experience as president of a leading university provides him with perspective into the challenges of managing complex, multi-faceted organizations. In addition, his service on the boards of other publicly-traded companies, including committee service, has given him insights and perspectives on governance and human resources and compensation which benefit the JC Penney Board.*

When examining directors' skills one at a time, it is not always clear that skills add value. For example, while Drobetz et al. (2013), Dass et al. (2013), and Faleye, Hoitash, and Hoitash (2018) find that directors' industry experience adds value, Kang, Kim, and Lu (2017) find that the effect of industry experience is insignificant in some circumstances. Similarly, Fich (2005) finds that shareholders seem to value Chief Executive Officer (CEO) experience of directors, while Fahlenbrach, Low, and Stulz (2010) find that CEOs do not add value.

We suggest one reason for these conflicting findings is that the ability of a director's skills to add value depends in part on the other skills that are represented on the board. If a CEO sits on a board with a lawyer then his skills may complement the lawyer's skills. But he may not always understand the lawyer's viewpoint (and vice versa) because he approaches problem-solving in a different way. In a theoretical model, the CEO and the lawyer might have different priors that lead them to disagree and invest inefficiently (e.g. Garlappi, Giammarino, and Lazrak, 2017). If a CEO sits on a board with other executives, there may be no

communication problems because the directors share common ground. However, a board with only executives may lack diversity in skills.

Our characterization of director skills allows us to test the idea that directors' skills are interdependent. We first show that directors are not one-dimensional. In a sample of 3,218 firm-year observations (1,031 unique firms) between 2010 and 2013, firms report that outside directors have on average 3.02 skills and inside directors have 3.33 skills.

As theory suggests, boards are also not one-dimensional. All boards have a director with finance and accounting skills. Boards also tend to have management skills (89.5% of boards) and leadership skills (74.7%) in common. But some boards will also have legal skills (34%) or risk management skills (27.6%), while others have manufacturing skills (37.3%) or entrepreneurial skills (16%).

As in Kaplan, Klebanov, and Sorensen (2012), Custodio, Ferreira, and Matos (2013), and Kaplan and Sorensen's (2017) examination of CEO characteristics, we use factor analysis to extract the main dimensions along which boards vary with respect to the skills of their directors. We find that boards vary primarily along one dimension: the diversity of skills that are available on a board. Some firms assign directors with many different skills to their board, while other firms focus on a few particular skills. As such, we conclude that there is an important distinction between diverse boards and boards with a substantial concentration of skills.

To provide further evidence that this distinction is important, we examine whether diversity of skills is related to firm performance as measured by Tobin's *Q*. Boards with greater skill diversity do not perform better. Using Blau (1977) measures of concentration of types, we find evidence that this result is plausibly driven by a lack of common ground in skill sets that arises with greater diversity. We view this evidence as consistent with the arguments in, e.g., Murray (1989), Knight et al. (1999), Pelled, Eisenhardt, and Xin (1999), and Simons, Pelled,

and Smith (1999) that having common ground among group members can facilitate effective decision making.

Our paper makes three main contributions to the literature. First, we move away from a one-dimensional treatment of directors and boards and focus on skill sets. Our finding that directors are multi-dimensional suggests that it may be difficult for outsiders to understand which skills of a particular director are the most valuable for a firm. A particular strength of the data is that it represents the firm's perspective rather than a perspective chosen by researchers. In this regard, we complement prior studies focusing on one particular skill of directors at a time, such as industry experience, professional skills, leadership skills, or financial skills.[1] We also complement Kim and Starks (2016), who use Regulation S-K to examine differences between the skills of male and female directors. They find that female directors contribute to skill diversity by providing new functional expertise.[2]

The second main contribution is that we characterize an important dimension along which boards vary with respect to skill. Just as Kaplan et al. (2012) and Kaplan and Sorensen (2017) expand our view on relevant CEO types, our study suggests that there are different board "types."

Finally, our paper complements the literature on board diversity (e.g., Adams and Ferreira, 2009; Anderson et al., 2011; Knyazeva et al., 2011) by showing how different measures of skill heterogeneity relate to the value of the firm. What distinguishes our paper from this literature is that we do not start with the premise that skill diversity may matter. Instead, diversity arises endogenously as an important characteristic from the factor analysis.

[1] See Fich (2005), Guner, Malmendier, and Tate (2008), Kor and Misangyi (2008), Fahlenbrach, Low, and Stulz (2010), Krishnan, Wen, and Zhao (2011), Faleye, Hoitash, and Hoitash (2018), Masulis, Ruzzier, Xiao, and Zhao (2012), Masulis, Wang, and Xie (2012), Dass, Kini, Nanda, Onal, and Wang (2013), Drobetz, von Meyerinck, Oesch, and Schmid (2013), and Bedard, Hoitash, and Hoitash (2014).

[2] Kim and Starks (2016) construct 16 skill categories, which overlap substantially with our 20 skill categories. Kim and Starks (2016) also reference an unpublished working paper by the same authors examining the relation between board skill heterogeneity and firm value. As of the writing of this footnote (March 2017), this working paper is not yet in the public domain.

Thinking of directors and boards as bundles of characteristics can lead to new and interesting insights concerning board decision-making. Garlappi, Giammarino, and Lazrak (2017) examine the role of heterogeneous priors and disagreement on board decision-making. The assumption of different priors is difficult to justify if directors are the same in all but one dimension. But, if directors differ in several dimensions, it is plausible that frictions in team decision-making can arise that affect firm outcomes.

The multi-dimensionality of director skill sets may also help explain outcomes in the director labor market. Studies relating individual director characteristics to firm value often face the challenge of explaining why firms do not optimize. If industry experience is positively related to firm performance, for example, then firms would do better by having more industry experts. The question is why they do not. If we view directors as one-dimensional, this question is difficult to answer. But if we view directors as multi-dimensional, it becomes easier. When firms appoint directors, they face a multi-dimensional search problem. In the presence of frictions, e.g., search costs, firms may not be able to optimize along every dimension. Similarly, in trying to fulfill governance regulations focusing on one characteristic, e.g., independence, or one objective, e.g., diversity, firms may not achieve the best match between new directors and the board. Thus, governance regulations may not always lead to better firm outcomes.

Incorporating a multi-dimensional perspective into governance theory and empirical work is challenging. But future governance research and policy may still benefit from recognizing that the governance problems firms face are more complex than we typically imagine.

2. Data

We describe our sample and then discuss whether the data on director qualifications contain information that is not readily available from other archival sources.

2.1. Sample description

We start with the 5,963 firm-year observations in the Institutional Shareholder Services (ISS, formerly Riskmetrics) database between 2010 and 2013 and eliminate 289 firm-year observations for firms that are headquartered overseas and 1,427 firm-year observations for utilities and financial firms (two-digit Standard Industrial Classification (SIC) codes 49 and 60–69). We obtain descriptions of directors' skills from our sample firms' proxy statements. The 2010 proxies contain the first descriptions of director skill sets following the 2009 amendment to Regulation S-K. We exclude 647 firm-year observations that were missing director skills for two or more directors on the board.

We obtain data on firms' financial characteristics for the fiscal years in which directors serve on the board from Compustat. Stock return data for the entire sample period are from Center for Research in Security Prices (CRSP). Board and director information is from ISS and data on all board committees and directors' committee memberships are from ISS and BoardEx. Information on whether firms have classified boards is from ISS and director appointment and departure dates are from BoardEx.

Our main performance measure is a proxy for Tobin's *Q*, which we measure as the book value of assets minus the book value of equity plus the market value of equity, divided by the book value of assets. We also examine the market reaction to director appointments and departures using standard event study methodology, which we describe in Section 5.2. Appendix A provides a detailed description of the variables in our study. After eliminating 310 firm-year observations with missing financial or governance data and 72 firm-year observations with extreme values of Tobin's *Q*, we end with a sample of 3,218 firm-year observations. Panel A of Table 1 reports summary statistics for financial and board-level

characteristics of these firms. Panel B reports summary statistics for characteristics of the directors of these firms.

[please insert Table 1 here]

The firms in our sample have an average market value of about $11.8 billion. They have an average Tobin's *Q* of 1.924, and return on assets (ROA) of 14.8%. The median firm has nine board members and three board committees.[3]

2.2. Regulation S-K and director skill sets

The December 16, 2009 amendments to Regulation S-K, which lays out reporting requirements for public companies in the United States, require companies to provide insight into their considerations for nominating directors. Item 401(e) of Regulation S-K states:

> *Briefly discuss the specific experience, qualifications, attributes or skills that led to the conclusion that the person should serve as a director for the registrant at the time that the disclosure is made, in light of the registrant's business and structure. If material, this disclosure should cover more than the past five years, including information about the person's particular areas of expertise or other relevant qualifications.*

The new rules became effective as of February 28, 2010 for fiscal years ending on or after December 20, 2009. The rule applies to proxy and information statements, annual reports, and registration statements, but not to foreign private issuers. Guidance from the Securities and Exchange Commission (SEC) emphasizes that disclosure should be provided on an individual, director-by-director basis. In 2010, 31 of our sample firms had annual meeting dates between January 1, 2010 and February 28, 2010. Although technically the rule did not yet apply to them, all of them followed the disclosure rule.

[3] The company with firm age equal to zero is Towers Watson & Co, which was created in 2009/2010.

Our sample contains data on 24,747 outside (independent or grey) director-year observations and 4,462 inside director-year observations. The total number of director-year observations in our data is thus 29,209 and of this 1,944 are newly appointed between 2010 and 2013. These directorships are held by 8,990 unique directors. From the 2010–2013 proxy statements we obtain firms' justifications for hiring the directors holding these directorships.

To ensure replicability, we code directors' skills using a text-based algorithm. We started by manually coding director skills in 2010 using a Conference Board (2010) analysis of Regulation S-K disclosure in 30 Dow Jones companies as a guideline. Using the 2010 coding we created a dictionary of the most frequent words and phrases belonging to each skill and used them to code skills in 2010–2013. We double-checked the accuracy of the coding using the 2010 data and refined our dictionary accordingly. Appendix B contains a more thorough description of our coding process and the creation of our skill categories. Table 2 provides an overview of our final set of 20 skills.

[please insert Table 2 here]

A classification as an "Academic" (for 8.1% of outside and 4.3% of inside directorships) indicates that the firm stresses that the director's academic position or PhD degree is an important determinant of the director's selection to serve as a board member. The classification "Company business" indicates that the firm chose the director because of his or her experience in the firm's business. We code all insiders as having "Company business" experience because we view the omission of this category from an insider's skill set as measurement error. We classify a director who was selected as a board member because of experience in compensation and benefits (for 9.2% of outside and 2.2% of inside directorships) as having "Compensation" skills. The other categories are: Entrepreneurial, Finance and

accounting, Governance, Government and policy, International, Leadership, Legal, Management, Manufacturing, Marketing, Outside board, Outside executive, Risk management, Scientific, Strategic planning, Sustainability, and Technology. Directors whose skills do not readily fall into one of our 20 categories or whose skills we cannot classify because the descriptions are too vague are assigned zero skills. Panel A of Table 3 reports mean skills by category for outside and inside directorships. Fig. 1 shows the distribution of director skills.

[please insert Table 3 here]

[please insert Figure 1 about here]

Several features of our classification are worth noting. First, directors are not one-dimensional. Instead, they have skill *sets*. The average director in our sample has 3.07 skills. Panel A of Fig. 2 shows the distribution of the number of skills per director type. Most directors have two or three important skills, regardless of whether they are inside or outside directors. While it is obvious that directors will have several skills, we believe it is worth highlighting because most empirical work on boards typically focuses on one skill at a time, e.g., industry, leadership, or professional experience.

[please insert Figure 2 here]

Although we believe the data resulting from Regulation S-K have great potential to inform governance research, it is challenging to work with for several reasons. First, the data encompass many dimensions. This makes it unsatisfying to simply characterize skills on the board using one-dimensional measures such as percentages of directors with certain skills. Second, firms' stated reasons for hiring directors may not reflect their true motives. We deal

with the first problem by examining board-level counts of skill categories, doing a factor analysis, and examining aggregate measures of individual directors' skills. We deal with the second problem by conducting various tests in Section 2.3 to examine if the data appear to be informative.

To characterize a firm's board of directors using board-level counts of skill categories, we examine whether a particular skill is mastered by at least one of the directors on a firm's board. A skill category receives a value of one if at least one director possesses this skill, and is zero otherwise. The final column of Panel A of Table 3 shows summary statistics for the board-level skills. Fig. 1 shows the distribution of skill types across firms. All boards have a Finance and accounting expert, which is not surprising given the emphasis on the role of financial experts after the Sarbanes-Oxley Act (SOX). Boards have experts in management, leadership, and international issues in more than half of the firm-years. Firms have experts in science and sustainability in fewer than 10% of firm-years. Panel B of Fig. 2 shows the distribution of the number of skills at the board level.

2.3. Are firms' stated reasons for appointing directors informative?

The primary concern one may have about the Regulation S-K data is that firms may not reveal the true reasons directors are valuable to them. Some suggestive evidence that this is not true comes from comparing descriptions of directors that are on the board in consecutive years. For these directors, we find that skill categories change (through the addition or subtraction of skills) 20.02% of the time in the four-year period we examine. This is consistent with the idea that firms' justifications for hiring directors change as director or firm circumstances change. To examine whether the reported skills under Regulation S-K are informative, we conduct five tests. We report the results of four tests below. In Appendix C, we examine whether we can verify at least one reported skill through other sources.

First, we examine whether the number of skills correlates with age and outside directorships. If reported skills are informative, one would expect people with more directorships to have more reported skills. Also, directors who are older are likely to have experience in more areas. We calculate correlations between the number of skills of every director and their age and number of outside directorships. When calculating the total number of skills per director, we exclude the "Outside board" category as it is mechanically related to the number of directorships. Panel B of Table 3 shows that the correlations between the number of skills and age (0.021) and outside directorships (0.072) are both positive, which suggests that the reported skills are informative.

Second, we examine whether the skills simply mirror the committee assignments directors have. If, for example, firms assign "governance" skills to everybody on the governance committee, and do not assign skills that are not related to committee membership, then the reported skills do not provide more information than the committee memberships already do. To construct the set of committee memberships for all directors, we start with data on compensation, audit, and governance and nominating committee memberships in ISS and supplement it with additional committee memberships from BoardEx.[4] Because firms vary in how they describe committees, we combine committees that have similar functions and rename them. Whenever there is a clear match between the function of a set of committees and the director skills we identify, we label the set of committees with the name of the skill. For example, "Antitrust Compliance" and "Special Litigation" committees perform similar functions that relate to directors' "Legal" skills, thus we classify these committees as "Legal" committees. We identify 37 types of committees in ISS and BoardEx and combine them into 20 different categories. Since one of these categories (Chairman committee) does not occur in

[4] ISS only contains information for three committees: audit, compensation, and governance and nominating. BoardEx has data on all committees. We started with ISS because the names of these three committees were already standardized. The same type of committee can appear under different names in BoardEx.

our sample, we end with 19 committees. Three types of committees do not have names that correspond to skills: the Securities, Reserves, and Real Estate committees. For the purpose of matching skills to committees, we assign the finance skill to the Securities committee. Since "Reserves" deals with management of reserves, we assign the management skill to the Reserves committee. To identify "real estate skills" we search director skill descriptions for "real estate" terminology. We then calculate the percentage of directors on a committee that firms describe as having the skill associated with the committee, for example, the percentage of directors on the governance committee with "governance" skills.

Panel C of Table 3 shows the number of occurrences of committees of a given type in our sample and the committee skill match ratio. After 2006, ISS duplicates committee information whenever a committee shares tasks (see Adams, Ragunathan, and Tumarkin, 2015). For example, if a firm has one Audit and Compensation committee, ISS will report that the firm has one Audit committee and one Compensation committee with equal membership. This explains why the number of compensation and governance committee-years is almost as high as the number of audit committee-years in our sample.

All match ratios are below 100%, which illustrates that assigned skills do not simply reflect the committees that directors are on. For example, in only 28% of firm-years do firms assign governance as a skill to directors on the governance committee. The average match ratio over all committees is only 32.5%.

Third, we examine whether firms use director skills to window dress poor performance. If this is the case, then we expect poorly performing firms to write more about their directors. We split our sample of director descriptions into those belonging to firm-years with above-median ROA (14,614 observations) and those belonging to firm-years with below-median ROA (14,595 observations) and count the average number of words firms use in describing the qualities of their directors in each subsample. Panel D of Table 3 shows the results. On average,

above-median ROA firms use 68 words to describe their directors and below-median ROA firms use 64.6 words. Thus, if anything, above-median ROA firms write more about their directors on average. However, the mean difference of 3.5 words is not economically significant and the standard deviations in the number of words are also fairly similar: 40.71 and 35.26 for above- and below-median ROA firms, respectively. Thus, these univariate results do not suggest that relatively better performing firms behave any differently in describing their directors' skills. In unreported robustness checks, we find that our main results in this paper are similar if we restrict our sample to above-median ROA firms, which also suggests window dressing is not a major concern.

Fourth, we examine whether firms attribute the same skills to directors with multiple directorships. There are 1,295 directors in our sample with more than one directorship within our sample firms. The average number of within-sample directorships that these directors have is 2.13. We examine how different firms report the skills associated with the same director. If the disclosure is informative, then we do not expect firms to report exactly the same skills for the same individual as this would mean that firms simply copy directors' biographies without considering which skills they deem relevant. On the other hand, if there is no overlap in reported skills then the reported experience is also not very informative, or at least highly subjective.

To compare firms' descriptions, we calculate a "clarity score" for directors on more than one board. In calculating this score, we exclude the "Company business" category, as this category would differ across firms almost automatically. We illustrate the clarity score using an example: If a director is on three boards, and 2/3 of the descriptions report skill A, 1/3 reports skill B, and 2/3 reports skill C, then the clarity score is the average of 2/3, 1/3, and 2/3. Thus, the clarity score will be positive and has a maximum value of one, which would indicate perfect overlap. Panel E of Table 3 shows that the average clarity score is 0.624. If we exclude insiders,

the clarity score is slightly higher with a mean of 0.632. On average, firms do not simply report directors' biographies, but there is still some overlap in the skills that they assign to directors.

3. The main dimension along which boards vary with respect to skill

A natural question is whether certain skills appear together on the board. An unreported correlation matrix for the 20 board-level skills suggests some skills do cluster. For example, boards that have risk management skills are more likely to also have at least one director with governance skills, but less likely to have a director with entrepreneurial skills. Our setting is similar to the setting in Kaplan et al. (2012) and Kaplan and Sorensen (2017), who have data on 30 characteristics and abilities of CEOs in private equity transactions. They use factor analysis to describe the main dimensions of variation between these characteristics. We follow their example to determine the main dimensions along which board-level skills vary. We exclude finance and company business skills from this analysis because all companies have them and there is no variation in these skills.

[please insert Table 4 here]

In the first four columns of Table 4 we report the result of factor analyses using the maximum likelihood method (ML). In the last four columns we report the results using the iterated principal factor method (IPF), which, unlike ML, does not require the assumption of multivariate normality. We only report factor loadings above 0.1 or below -0.1. The results are very similar using both methods.

The first factor has positive loadings on virtually all classifications. This shows that some boards possess many classifications, while others do not. So the main dimension along which boards vary is in their skill diversity.

Similar to the factor analysis of managerial skills in Custodio et al. (2013), the eigenvalues are not very high, with only the eigenvalue of the first factor being above one. As the eigenvalue of the first factor is more than double the eigenvalue of the second factor, we focus on the first factor, indicating the diversity of skills that are available on the board, which captures about 53.5% of the variation in skills.[5]

4. Skill diversity and firm performance

Our factor analysis indicates that the diversity of skills on a board is the primary dimension among which boards of directors vary. Organizational research emphasizes that diversity of skills might be beneficial in decision-making as it brings greater resources to problem-solving and could lead to a more complete analysis of an issue (Milliken and Martins, 1996; O'Reilly and Williams, 1998). However, different personal and professional backgrounds may lead to different ways in which team members interpret information and to multiple representations of a problem (Beers et al., 2006; Hambrick, 2007). Misunderstandings and disagreement can then threaten effective decision-making processes within multidisciplinary teams. For example, Garlappi, Giammarino, and Lazrak (2017) show that when directors have heterogeneous priors, boards may underinvest in multi-stage projects because they anticipate future disagreement. In their model, security issuance can help alleviate the underinvestment problem. Changing board composition may also work. Murray (1989), Knight et al. (1999), Pelled, Eisenhardt, and Xin (1999), and Simons, Pelled, and Smith (1999) argue that having common ground among group members can overcome some of the problems of heterogeneous teams.

[5] Due to the binary nature of our skill variables, we obtain factors based on a tetrachoric correlation matrix in a robustness test following the recommendations of Panter et al. (1997). We obtain similar factors and have confirmed that our results in the remainder of the paper are robust to using factors based on the tetrachoric correlation matrix.

Since there may be advantages and disadvantages to having more diversity of skills on a team, it is an empirical question how director skill diversity relates to performance on average.

4.1. The relationship between the factors and firm performance

We examine the relation between firm performance and the first factor from both our ML and IPF factor analysis in Table 5. We regress our proxy for Tobin's *Q* on our factors and a set of controls that are common to governance performance regressions (e.g., Yermack, 1996; Adams and Ferreira, 2009; Faleye, Hoitash, and Hoitash, 2018). As governance controls we include variables that plausibly relate to both performance and skills. For example, we expect the number of skills to be positively related to board size and board independence. As the number of committees increases, firms might also add more directors with relevant skills to their board.[6] As the diversity literature argues (e.g., Milliken and Martins, 1996), skill diversity may affect communication, so we include the logarithm of the number of board meetings.

As firm-level controls, we include the logarithm of assets as a proxy for firm size, the number of segments as a proxy for diversification, capital expenditures, ROA, volatility, and the natural logarithm of firm age. We provide the exact definitions of the control variables in Appendix A. All models include two-digit SIC code industry effects and year fixed effects and the standard errors are corrected for potential heteroskedasticity and clustering at the firm level.

[please insert Table 5 here]

[6] We use the number of committees in ISS plus any additional committees from BoardEx as our measure of the number of committees. As we discuss in Section 2.3, this measure can more naturally be interpreted as a measure of the number of key committee tasks. Results are robust to excluding the number of committees.

Column 1 of Table 5 shows that the ML diversity of skills factor is negatively related to the firm's Tobin's *Q*. This relation is robust to controlling for other firm characteristics, as can be seen in Column 2, and to the use of the IPF factor method, as can be seen in Columns 3 and 4. The coefficients on the firm-level controls are generally consistent with previous literature. The negative coefficient on board meetings is consistent with Vafeas (1999), for example.

4.2. Measuring the diversity of skills

Factor analysis is sometimes unappealing because it is difficult to assess the economic magnitudes of coefficients on factors. It is also difficult to make the arguments necessary for instrument validity in an instrumental variable (IV) analysis when the endogenous variable is a factor. Thus, we examine whether the factor has a more intuitive counterpart in the data. An obvious choice is to simply count the number of skills that are represented on a board. The typical firm has ten different skills on the board in a given year. In unreported results, we show that the correlations between the number of skills and the ML and IPF factors are 0.921 and 0.967, respectively. Columns 5 and 6 of Table 5 confirm our finding from the factor analysis that the number of skills and Tobin's *Q* are negatively related. Thus, the number of skills seems to capture the essential meaning of the factor.[7]

4.3. Potential reverse causality

While the results from Table 5 suggest that there is a negative correlation between skill diversity and firm performance, we cannot immediately give this relationship a causal

[7] We also examine the role of committees in characterizing skills using two variations on the number of skills. First, we assign a director any of the 20 skills belonging to committees on which he sits and that are missing from his skill description. For example, the director may sit on the finance committee, but the firm did not mention that he has finance skills. For the second measure, we exclude from a director's skill descriptions any skill that matches to a committee on which he sits. We then use these director-level measures to reconstruct the board-level number of skills. Our performance regressions yield similar results with these variations.

interpretation because of potential endogeneity problems due to reverse causality. It is plausible, for example, that underperforming firms look for more skill diversity on their boards to get different advice. Another potential concern is that underperforming firms engage in window dressing by making their directors appear more talented than they really are. These arguments would predict a negative relationship between performance and skills. On the other hand, it is also possible that poorly performing firms have other concerns and pay less attention to the new regulation as a result. This argument would predict a positive relationship between performance and skills. Without a better understanding of how directors match to firms, it is difficult to sign the bias in the ordinary least squares (OLS) results. We attempt to formally address this concern in our set-up using an instrumental variable analysis.

We use two instruments whose summary statistics are provided in Appendix D. Since both instruments are time-invariant, we conduct our IV analysis for the 2010 cross-section only.

For our first instrument, we exploit the fact that the amendments to Regulation S-K include a requirement in Item 407(c)(vi) for firms to disclose how they consider diversity in the director nomination process. Item 407(c) does not specify the type of diversity the regulation pertains to.[8] Since it was bundled with Item 401(e) concerning disclosure of director skills, it is plausible that firms interpreted 407(c) as pressure to increase skill diversity on the board. If so, we might expect firms with more time to incorporate Regulation S-K's requirements to attempt to increase diversity by appointing new directors to the board. Fig. 3 provides some evidence consistent with our expectations: the proportion of firms appointing new directors in a given proxy month is higher the later the month occurs relative to the passage of Regulation S-K. Thus, we define our instrument to be the number of days between the day the 2009 amendments to Regulation S-K were passed and the filing of the firm's proxy

[8] In 2015, nine pension funds petitioned the SEC to add disclosure about gender, race, and ethnicity diversity to Regulation S-K (https://www.nctreasurer.com/inv/Resources/ProxyRuleAmendmentPetition.pdf).

statement in 2010. Based on the evidence in Fig. 3, we expect this instrument to be correlated with the number of skills on the board.

[please insert Figure 3 here]

On the other hand, we believe it is unlikely that the number of days between Regulation S-K and the proxy filing is correlated with firm performance in 2010, as long as the proxy filing date does not change in response to poor performance. We collect proxy filing dates for 2009 and 2010 from the SEC's Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) and examine whether there were any changes in the dates. Fig. 4 shows the distribution of changes between the two years. As is evident from the figure, most changes occur in the -1, 0, +1, day range, which is reasonable if annual meetings are held close to or on the weekend and firms send their proxy statements out a fixed number of days before the meeting.[9]

[please insert Figure 4 here]

The second instrument is a dummy if a firm is within 70 miles (roughly an hour's travel distance away) of an airport hub—an airport that handles over 1% of annual passenger boardings according to the Federal Aviation Authority (http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/). The rationale for this instrument is that firms are less constrained in choosing directors when it is easy for them to attend board meetings and this may lead to an increase in skills on the board. Of course, distance to the airport may be directly correlated with firm performance because it

[9] To ensure our results are not sensitive to firms changing their annual meeting dates, we drop firms with more than 14 days difference in the proxy filing date between 2009 and 2010 (16.17% of the sample). The results are consistent with the results using the full sample and are available upon request.

may affect firms' transportation networks. But we believe that to a large extent this effect should be controlled for by other variables in our regression, for example, firm size, diversification (i.e., the number of segments), and industry.

Column 7 of Table 5 shows the results of the second stage of the IV regression of the specification in Column 6. We report the coefficient on the instruments from the first-stage regression at the bottom of the table. The first-stage coefficients on our instruments have the expected signs and are statistically significant. However, the Kleibergen-Paap Wald statistic (7.98) is mid-way between the Stock-Yogo cutoffs for 25% (7.25) and 20% (8.75) maximal IV size, which suggests the magnitudes of our second-stage coefficients are still biased.[10]

To gain confidence that the bias does not affect the sign of the coefficient on the number of skills, we substitute the instruments for the number of skills in the Tobin's *Q* regression in Column 6 of Table 5. Under the assumption that the instruments are exogenous, the coefficients on the instruments in this reduced form are consistent estimates of the population coefficient on the number of skills multiplied by the coefficients on the instruments in the first-stage regression. The coefficients on both instruments in the reduced form are negative. Since the coefficients on the instruments in the first stage are both positive, we infer that under our assumptions the "true" coefficient on the number of skills is indeed negative.

In the second-stage IV regression, the coefficient on the number of skills is negative. The coefficient is also more negative than in the OLS regressions. This suggests that the bias is positive [see the expression for the OLS bias in, e.g., Adams, Almeida, and Ferreira (2009)], i.e., poorly performing firms appear to focus on skills rather than seek out greater skill diversity for their directors. Because the coefficients on the number of skills are negative in both OLS

[10] We also conduct endogeneity and overidentification tests. We reject the null that the number of skills is exogenous in the Tobin's *Q* regression at the 10% level. We cannot reject the null that the overidentifying restrictions hold (*p*-value of 0.26).

and IV specifications, we interpret our results as suggestive of a negative causal effect of skill diversity on performance.

From Column 7, a one standard deviation increase in the number of skills (2.928) is associated with a 32.26% reduction in Tobin's *Q* at the mean. This is clearly too large and confirms our suspicion that the IV results may be consistent but not unbiased. The economic magnitude of skills in Column 6 is -2.44%. Since the IV results are more negative than the OLS results, one way to interpret the economic magnitudes is to take -2.44% as an upper bound for the effect of the number of skills on performance. Since this effect is arguably already economically significant, our results suggest that skill diversity is economically important.

5. Common ground in director skills

We document that diversity is the main dimension along which boards vary with respect to skill. An important question is what drives the negative relationship between skill diversity and performance. A potential explanation for this finding is the importance of having common ground in the boardroom, i.e., the need for directors to share skills in order to be able to communicate effectively. We examine this potential mechanism in two ways.

First, we construct a direct measure of skill overlap between directors and examine how it relates to performance. Although the number of skills is likely to be negatively related to common ground in the boardroom, it is not a perfect measure because it is possible that some boards have directors who have many skills in common. Second, we examine whether boards with greater skill diversity try to focus their skills through director turnover.

One difficulty we face in the latter analysis is that Regulation S-K can be interpreted to be a push for greater diversity. The evidence from Fig. 3 and our IV strategy is consistent with this idea. The fact that Regulation S-K is at the center of current calls for greater gender and racial board diversity [see, e.g., SEC Chair Mary White's keynote speech (White, 2016)] is

also consistent with this idea. Thus, firms with low common ground may not have been as free to refocus their skills in this time period as they might otherwise have. Nevertheless, as we document below our evidence is suggestive that firms with low common ground attempt to focus skills.

5.1. Measuring common ground

To measure the concentration of skills among directors, we use the Blau index. We compute the board-level Blau index (Blau, 1977) as $1 - \Sigma p_i^2$, where p is the proportion of total director skills (the sum of all skills of all directors) in the kth skill category. By construction, the Blau index is between zero and (K – 1)/K, where K is the maximum number of skills, which in our case provides a theoretical maximum of 19/20. A high Blau score indicates a low concentration of skills among directors and low levels of common ground.

Communication problems between insiders and outsiders may be particularly important for decision-making. Accordingly, we also calculate an inside-outside Blau index that measures the concentration of skills between insiders and outsiders. To calculate the insider-outsider index, we treat all insiders as one individual with the combined skills of the insiders and we treat all outsiders as an individual with the combined skills of the outsiders and use the Blau formula. Panel A of Table 6 shows descriptive statistics for the Blau indices.

[please insert Table 6 here]

The Blau score is on average 0.853, with a minimum of 0.142. The average inside-outside Blau score is slightly higher (0.884). Panel B of Table 6 shows the correlation between the Blau scores, the ML and IPF factors, and the number of skills. The correlations are quite high. The correlations of the Blau score with the factors and the number of skills range from

0.727 to 0.809. The correlations of the inside-outside Blau scores with the factors and the number of skills range from 0.804 to 0.891.

Panel C shows the results of replicating our OLS performance regressions using the Blau scores instead of the factors and the number of skills. Consistent with our previous results, the coefficients on the Blau scores are negative in all specifications and significant except for inside-outside Blau in Column 4. The difference between these results and our previous ones, however, is that we can interpret the coefficients in terms of common ground. These results suggest that skill diversity leads to less effective decision-making because directors have less common ground (as measured by skill overlap).

5.2. The value of common ground

Our evidence suggests that directors are bundles of skill characteristics. This means firms may not be able to optimize over every skill dimension. If firms appoint a particular director because he or she is a finance expert, for example, that director will come with other skills that the firm may not need or that make communication with other directors difficult. Trying to find another director without those skills may not be feasible in the short run. In the long run, frictions in communication may lead these directors to leave the board more quickly either voluntarily or because the firm asks them to.

To gain further insight into the channel through which skill diversity may affect performance, we examine the market reaction to departures and additions of directors, what types of directors leave boards, what types of directors join, and how these changes affect the overall balance of skills on the board.

5.2.1. The market reaction to skills

In Table 7, we estimate a market model in a (-2, +2) window around director departures and appointments. We use the CRSP value-weighted index returns to proxy for market returns and estimate the parameters of the normal performance model using a (-255, -46) estimation period. To ensure we can attribute the market reaction to particular directors we only allow director departures and additions to enter our event sample if no other director departs or joins the board on the same day. We also exclude event dates that coincide with proxy filing dates and departures of directors who might be considered to be retiring from board service. In the Spencer Stuart U.S. Board Index in 2015, the mandatory retirement age is 72 and above in 94% of companies.[11] Thus, we exclude all departures of directors at or above the age of 72. Our final sample consists of 343 departures and 618 additions to the board.

[please insert Table 7 here]

Panel A of Table 7 shows the average cumulative abnormal returns (CARs) around director departures and appointments. Consistent with previous studies (e.g., Shivdasani and Yermack, 1999; Ferris, Jagannathan, and Pritchard, 2003; Fich, 2005), the mean reaction to board changes is statistically insignificant. In Panel B, we examine the market reaction to departures and appointments of directors who may contribute to a lack of common ground by having skills that no other director on the board shares, which we label "unique" skills. In Panels C and D, we examine the average market reaction in firms with departures of directors with greater and less than the median number of skills and greater and less than median Blau index values.

[11] https://www.spencerstuart.com/~/media/pdf%20files/research%20and%20insight%20pdfs/ssbi-2015_110215-web.pdf?la=en

The mean market reactions to director appointments remain insignificant. One reason may be that director appointments are often anticipated and it is hard to know exactly when the information about the appointments becomes public. But if director appointments are anticipated to a similar extent in all subsamples, comparing mean market reactions may still be informative. Panels B and C suggest, for example, that the market may value departures of directors whose skill sets contribute to a lack of common ground. The market reaction to the departure of directors with unique skills is 0.96% more positive than the market reaction to departures of directors without unique skills, a difference that is statistically significant at the 10% level. Similarly, the market reaction to the departure of directors with above-median number of skills is 0.82% more positive than the market reaction to departures of directors with below-median number of skills, a difference that is also statistically significant at the 10% level.

5.2.2. Skills and director departure and additions

If mismatches in skill sets are problematic for boards, we might expect directors with unique skills to be more likely to leave the board if firms do not feel too much pressure to retain them for diversity reasons. Between 2010 and 2012, 1,478 directors depart their directorships at our sample firms. We examine the relationship between the likelihood of director departure and unique skills in Panel A of Table 8.

In the sample of directorships we regress a dummy that is equal to one if a director leaves the position during the year on various measures of unique skills and director-, board-, and firm-level variables that we believe are plausibly related to skills and the likelihood of departure. The director-level characteristics we include are independent director and female dummies, the number of outside board seats directors have, director tenure, and a dummy that is equal to one if the director is a member of the audit committee. We control for retirements

by including a retiring director dummy that is equal to one if the director is 72 or older. The board-level controls we include are board size and a dummy that is equal to one if the board is classified. We include the log of total assets and ROA as firm-level controls. All specifications include year and firm fixed effects. We cluster all standard errors at the firm level.

[please insert Table 8 here]

Our analysis of the market reaction to director departures suggests that director changes in firms with above-median Blau indices are on average neutral events (see Panel D of Table 7). From Column 1 of Panel A of Table 8, it appears as if the Blau index is on average also not correlated with the likelihood of director departure. But this result appears to be driven by the fact that we treat directors of different types the same in Column 1. In Column 2, we add the number of unique skills a director has (Unique skills) as well as the interaction between the Blau index and Unique skills to the regression. The negative coefficient on Unique skills is consistent with the idea that firms may have felt pressure to retain directors who enhanced their skill diversity. However, the positive and significant interaction term suggests that directors with more unique skills have greater turnover on boards with low common ground. Results are similar if we replace Unique skills with the dummy for unique skills (Column 3) or the fraction of skills that are unique (Column 4).

The results in Panel A of Table 8 suggest that mismatches in skill sets may be particularly problematic on boards with low common ground. If the unique skills of departing directors are valuable, we would expect firms to try and replace them. But if the departure of unique directors is partly driven by mismatches in director skill sets, we would expect firms to try to focus their boards' skill sets. We examine the net effect of departures in a sample of

departures for which the number of directors joining the firm is the same as the number of directors leaving the firm (including retiring directors) in a given year.

We identify 275 directors whose departures are paired with new additions to the board. Panel B of Table 8 shows summary statistics for the number of unique skills and the number of skills for departing and joining directors for the full sample and for above- and below-median Blau firms. Results for the other measures of unique skills are similar. Since departures occur in different years in different firms, we calculate the median of the Blau index using the entire sample of firm-years. We label the means for departing directors with one, two, or three stars when the differences in means between departing and joining directors are statistically significant at greater than the 10%, 5%, or 1% levels in a paired *t*-test.

Consistent with the idea that it may be difficult for firms to optimize the skills of their directors along all dimensions during this time period, few of the differences in means are statistically significant. However, the magnitudes of the differences in means exhibit a pattern that is consistent with a focusing of skills on boards with low common ground. In the full sample and the above-median Blau firms every variable mean for joining directors is lower than for departing directors.

6. Conclusion

We exploit Regulation S-K's recent requirement that U.S. firms must disclose the skills that their directors bring to the table and document that directors are not one-dimensional. We believe that recognizing this fact has important implications for corporate governance. Because director characteristics are bundled, firms may not be able to optimize over individual director characteristics. Instead, firms may face multi-dimensional constrained optimization problems that may be difficult to solve especially when they are subject to regulations focusing on one characteristic, e.g., independence, or one objective, e.g., diversity.

We find that the main dimension along which boards of directors vary is in the diversity of skills on their board. When examining the relation between this dimension and firm performance, we find that boards whose directors have more commonality in skill sets have better firm performance. Overall, the new skill data that we exploit provide insights into what directors bring to the table, how boards are structured, and when boards perform best.

Appendix A. Variable definitions

We provide the definitions of the variables we use in the study in this table.

Variable	Definition
Airport proximity dummy	A dummy variable equal to one if there is a large hub airport within a 70-mile radius of the firm's headquarters and zero otherwise. Distance to an airport is calculated as the Great Circle distance of the firm's headquarters to an airport in miles calculated using the code provided by SAS Institute (http://support.sas.com/kb/5/325.html).
Audit committee	A dummy variable equal to one if the director was serving on the audit committee and zero otherwise.
Blau score	The concentration of skills among directors following Blau (1977). We calculate the Blau score as $1 - \Sigma p_i^2$. The Blau index is between zero and (K – 1)/K where K is the maximum number of skills, which in our case provides a theoretical maximum of 19/20. Higher Blau scores indicate lower concentration of skills and lower common ground among directors.
Board committees	The number of combined board committees that the firm has as reported in BoardEx and ISS.
Board independence	The ratio of independent directors on the board to the board size.
Board meetings	The annual number of board meetings held during the year.
Board size	The number of directors on the board.
Business segments	The number of business segments that the firm has.
Capital expenditures	Capital expenditures over sales (#capx / #sale).
CEO age	CEO's age at the time of the proxy.
Classified board	A dummy variable equal to one if directors on the board are elected on a staggered basis and serve a term of two or three years before coming up for election again.
Director age	Director's age at the time of the proxy.
Director tenure	The number of years the director has served on the board.
Director skills	The number of skills that the director has.
Female director	An indicator variable equal to one if the director is a female director and zero otherwise.
Firm age	The number of years since each firm's CRSP listing date.
Firm size	Total assets (#at) in millions of dollars.
Unique skills	A unique skill is a skill possessed by only one director on the board. The unique skills variable counts the number of skills possessed by the director that are not possessed by other directors.
Unique skills dummy	A dummy variable equal to one if the director has at least one unique skill and zero otherwise.
Unique skills fraction	The ratio of the number of unique skills that the director has to the total number of skills the director has.
Independent director	A dummy variable equal to one if the director is an independent director and zero otherwise.
Inside-outside Blau score	The concentration of skills between inside and outside directors. This measure is calculated similar to the Blau score by treating inside and outside directors as separate groups and combining skills within each group.
Market value of equity	Number of shares outstanding (csho) times stock price (prcc_f).
Number of skills	The number of skills that are represented on the board (out of 20).

Outside boards	The number of outside board seats held by the director.
Retiring director	A dummy variable equal to one if the director is 72 or over and zero otherwise.
ROA	Operating income before depreciation (#oibdp) divided by total assets.
Time since announcement	The difference in days between the date of proxy filing and the date of rule announcement by the SEC.
Tobin's *Q*	The sum of total assets (#at) and market value of equity less book equity (#ceq), divided by total assets.
Volatility	Standard deviation of the firm's daily stock returns during the year.

Appendix B. Skill dictionary and description of coding process

We present the list of words and phrases that we use to identify director skills from skill descriptions in Appendix B.1. The description of our coding process is in Appendix B.2.

B.1. Skill dictionary

Skills	Keywords and phrases
Academic	academia, academic, dean, doctorate, education, faculty, graduate, masters, Ph.D, PhD, professor, school environment
Company business	all aspects of our industry, chief executive officer of our, chief executive officer of the company, company's business, executive of our, executive of the company, experience with the company, historical insight, historical knowledge, history of the operation, history with our company, in-depth knowledge of, industry-specific perspective, industry experience, industry knowledge, inner workings, insider's perspective, internal operation, knowledge of all aspects of the company, knowledge of the, knowledge of the history, officer of our, officer of the company, president of our, president of the company, the company's chief, understanding of our business, working with the company
Compensation	compensation
Entrepreneurial	entrepreneur, entrepreneurial, entrepreneurship, evaluating business, innovative idea
Finance and accounting	accountant, accounting and, accounting experience, accounting principles, and accounting, auditing, banking, capital markets, capital structure, corporate finance, experience in accounting, experience in finance, expertise in finance, finance experience, finance industry, finance matters, financial accounting, financial acumen, financial background, financial experience, financial expert, financial expertise, financial field, financial foundation, financial management, financial matters, financial reporting, financial services, investment, securities, understanding of finance
Governance	governance
Government and policy	government, policy, politics, regulatory
International	global, international, multinational, worldwide
Leadership	leadership
Legal	attorney, lawyer, legal
Management	experience in leading, experience in managing, management
Manufacturing	industrial, manufactured, manufacturing
Marketing	marketing
Outside board	board experience, board of other, board practices of other, boards of companies, boards of other, boards of several other, boards of various, director of other, director of several other, member of the board of, numerous boards, on the boards of, other company boards, prior service as a director, several corporate boards, several other corporate boards, varied boards
Outside executive	as the chairman of a, business career, chief executive officer of a, executive experience, experience as a chief, experience as an executive officer of, experience as a senior, former executive of a, officer of a public, officer of other, officer of several companies, officer of numerous companies, president of a, senior-level executive, senior executive, senior management positions, serving as the CEO of a
Risk management	risk
Scientific	research and development, scientific expertise
Strategic planning	business planning, decision-making, problem-solving, strategic, strategies
Sustainability	environmental, safety, sustainability, sustainable
Technology	technological, technology

B.2. Coding of skills

We used Named-Entity Recognition (NER) techniques to create a set of keywords that identify director skills in our sample of proxy statements. NER uses contextual information to locate and classify elements in free-form text into predefined (named) entities (Jiang, 2012). In our study, these named entities are skills.

We use a rule-based approach which we implement using the information extraction system ANNIE (A Nearly-New Information Extraction system) in the open source software GATE (General Architecture for Text Engineering, https://gate.ac.uk). In our context, implementing ANNIE is similar to using Stata to tag keywords in strings. However, ANNIE is quicker and more efficient because it ignores punctuation. ANNIE components consist of a document reset resource which removes all annotation sets, a tokeniser which splits the text into simple tokens such as numbers, punctuation, and words of different types, a dictionary that is used to identify named entities in the text, a sentence splitter that segments the text into sentences, and a tagger that produces a part-of-speech tag as an annotation on each word or symbol.

To implement the NER we require a dictionary of words describing skills. We create this list using an iterative process. Because director skills have not yet been studied broadly, creating this list requires some judgment. The steps for creating the dictionary are as follows:

1. We defined an initial list of 20 skills that we believed to be relevant. We start with a list of 20 skills from a Conference Board publication (Conference Board, 2010). Conference Board (2010) analysed Regulation S-K disclosure in 30 Dow Jones companies and identified 20 director skills. We modify their categories as follows. We drop the "Operations" category as we believe most directors have some operational experience. We also drop "Philanthropic or Non-Profit Experience" as it occurs so rarely (fewer than 2% of directors). We then add the categories of "Management" and "Outside Executive Experience" because a substantial number of firms in our sample report these as being important. Table 2 provides an overview of our final set of 20 skills.
2. We assigned a research assistant to read the descriptions of 13,862 directors in the 2010 proxies and to code skills for each director. To ensure consistency, the same person coded all directors' skills and we verified them at random.
3. We then created word clouds and tables of frequent words and phrases in the descriptions of directors with specific skills. We start with phrases of ten words (without punctuation). The top ten more frequent keywords and phrases form the initial lists in the dictionary.
4. We executed the NER on the 2010 proxies to compare the accuracy of the classifications and updated the list of words and phrases in the dictionary with additional high frequency terms when the output from the NER diverged substantially from the hand-coded output. As the number of words and phrases defining the skills in the table above suggests, this was straightforward for some cases, e.g., Compensation skills, but less straightforward for Company business, Outside board, and Outside executive skills.

5. We then reduced the phrases to the smallest set of words that define the skill (e.g., "dean of" can be reduced to "dean") and double-checked to ensure using the final set of parsimonious phrases led to the same coding of skills as with the less parsimonious set of phrases.

To implement our coding of skills, it is sufficient to create dummy variables that are equal to one whenever a director's skill description contains any of the keywords we assigned to a given skill category (ignoring punctuation and upper versus lower case spelling).

Appendix C. Verification of skill reporting

As a final check whether firms' descriptions are informative, we examine whether we can verify at least one reported skill through other sources. For many skills, we could not identify another data source that we could use to double-check firms' descriptions, e.g., "Leadership" or "Strategic Planning." Even for skills for which we could identify sources, it proved prohibitively time-consuming to verify each skill. Thus, we focus on a skill that is relatively easy to measure and for which it should be straightforward to characterize measurement error, namely, the "International" skill. Due to the time-intensive nature of the check, we perform this check for the original hand-coded data in 2010 only.

To verify "International" skills, we use education, work history, and board seat data in BoardEx. We match our sample of directors in 2010 on names and company to BoardEx. Due to incomplete coverage of directors in our sample and missing education data, we end with a sample of 4,735 out of 6,643 directors with information in BoardEx. According to BoardEx, 2,110 of these directors have some international experience in the form of non-U.S. education (344), non-U.S. employment (1,224), or non-U.S. board seat experience (1,326). These categories are not mutually exclusive as some directors fall into more than one category.

Our sample firms report international skills for 1,332 of the 4,735 directors with BoardEx information. Of these 1,332, 747 (56.08%) have some form of international experience according to BoardEx. To examine why firms report international skills for directors who do not have international experience according to our BoardEx classification, we did a random check of skill descriptions. In each case, the firm reported that the director had experience with international expansion or international merger and acquisition activity. So firms appear to be reporting skills accurately.

Firms do not appear to be simply copying directors' CVs. For 1,363 out of 2,110 (61.67%) of our directors who have some international experience according to our BoardEx classification, firms do not indicate that international experience is important. It is possible that firms underreport skills, which means we underestimate skill diversity on the board. It is also possible that the international experience is simply less important for these directors. More of the directors for whom firms do not report international skills are American (62.31%) than the directors for whom firms report international skills (56.76%). If the Americans' international experience arose because they were exchange students abroad, for example, then this may be irrelevant for firms.

Appendix D. Summary statistics for the instruments

We provide summary statistics for our instrumental variables in this table. Our instruments are time since announcement and airport proximity dummy. Since these instruments are time-invariant, we use the 2010 data, which gives us 736 firms, in our analysis. Time since announcement, our first instrument and reported in the first row, is measured as the number of days between the filing of the firm's proxy statement and the day Regulation S-K was announced. A large hub airport is an airport that handles over 1% of the annual passenger boardings. In the second row, we calculate the minimum distance in miles to a large hub airport of the firm's headquarters. In the last row, we create our second instrument as a dummy variable that is equal to one if there is a large hub airport within a 70-mile radius of the firm's headquarters.

Variable	Mean	Median	Standard deviation	Min.	Max.
Time since announcement (days)	148.53	114	78.92	20	379
Minimum distance to a large hub airport (miles)	57.89	23.37	78.26	0	421.60
Airport proximity dummy	0.72	1	0.45	0	1

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Fig 1. Director and board skills. This figure shows the percentage of directors (firms) with specific skills. For example, the most common skill among directors (firms) is management (finance and accounting and company business). Approximately 38% of all directors (grey bars) have management skill and all firms (black bars) have at least one director on the board with finance and accounting skill and at least one director with experience in the company's business. Sample characteristics are provided in Table 1. Sample averages are reported in Table 3.

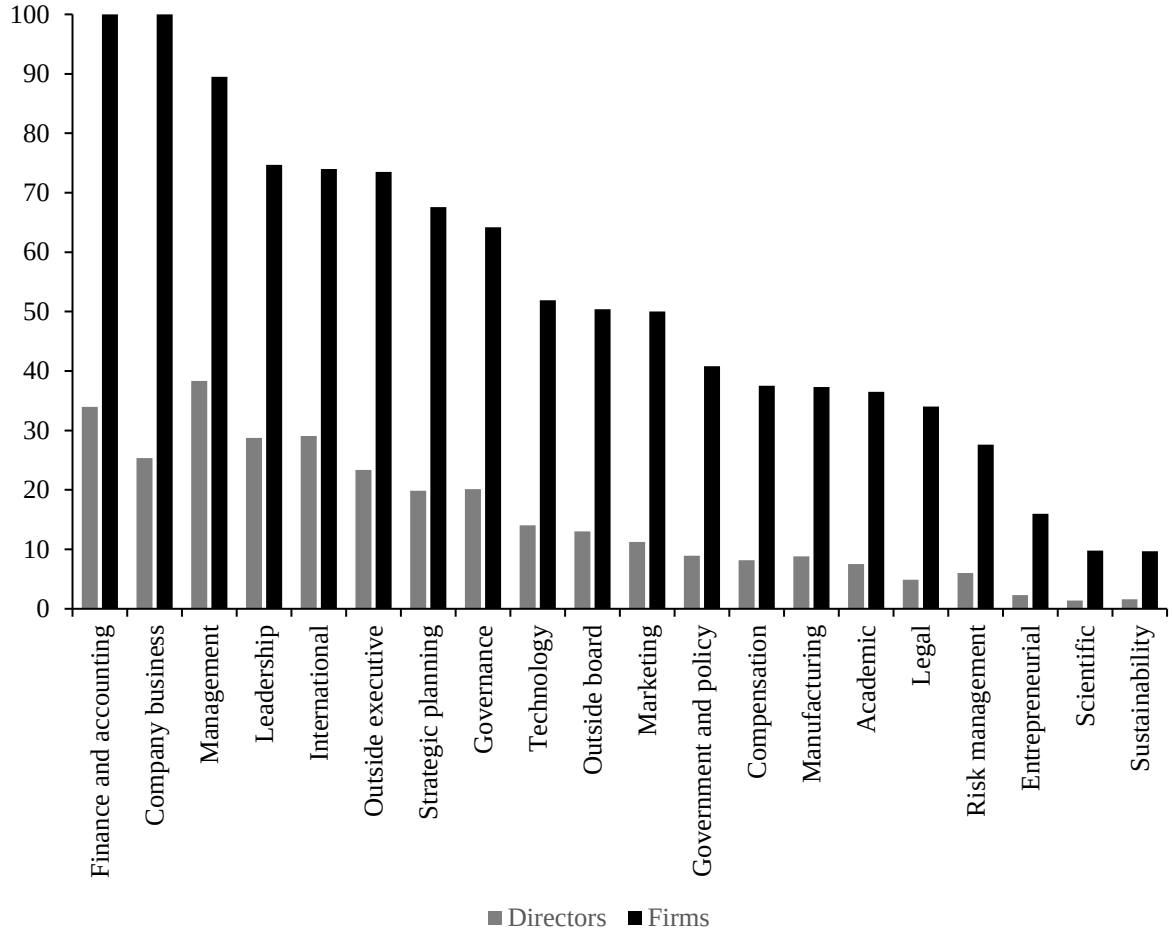
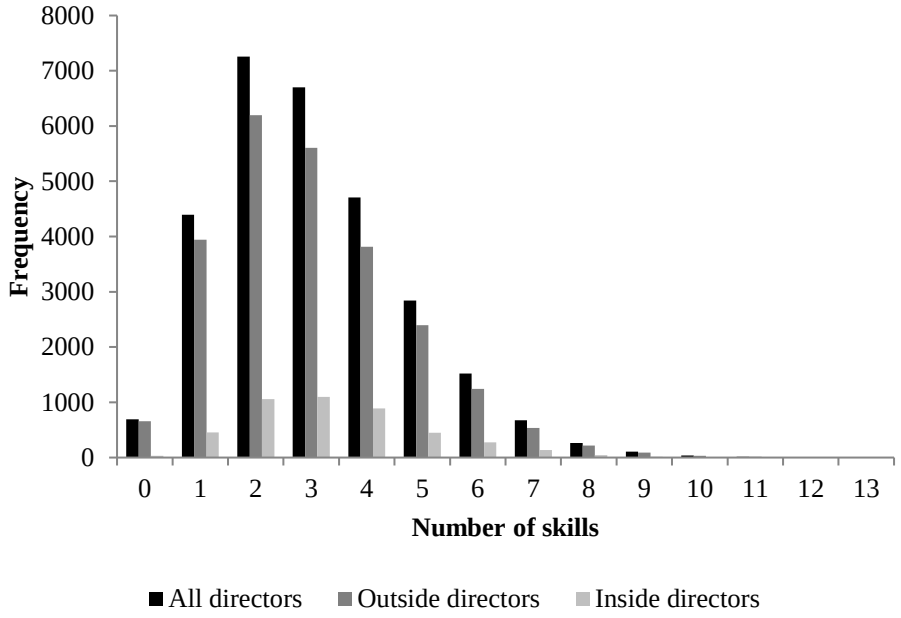


Fig. 2. Number of skills. We present the number of skills per director and the number of skills represented at the board level in this figure. Panel A is for the number of skills at the director level and Panel B is for the number of skills represented at the board level. Panel A is based on 24,747 outside director-year and 4,462 inside director-year observations. The average director has 3.07 skills in our sample and this decreases to 3.02 for outside directors and increases to 3.33 for inside directors. The maximum number of skills possessed by an outside (inside) director is 13 (13). Any director who has a skill that is not in our list of 20 skills is classified as having zero skills. Panel B is based on 3,218 firm-year observations. The average number of skills represented on the board is 10.42. The minimum (maximum) number of skills represented on a board is two (20). Sample characteristics are provided in Table 1.

Panel A: Director skills



Panel B: Number of skills at the board level

Fig. 3. New directors. We examine new director nominations in this figure. There are 390 new director nominations in our sample of 736 firms in 2010. The horizontal axis is the number of months between the proxy statement date and the Regulation S-K rule announcement date (December 16, 2009). The left vertical axis shows the number of new directors per firm after the rule announcement date. The right vertical axis shows the percentage of firms with proxy statements within a particular month that had new directors. For example, out of 273 firms that had proxy statements four months after the rule announcement date, there were 122 new directors which corresponds to 0.45 new directors per firm (left axis) and 32.23% of those 273 firms had at least one new director (right axis).

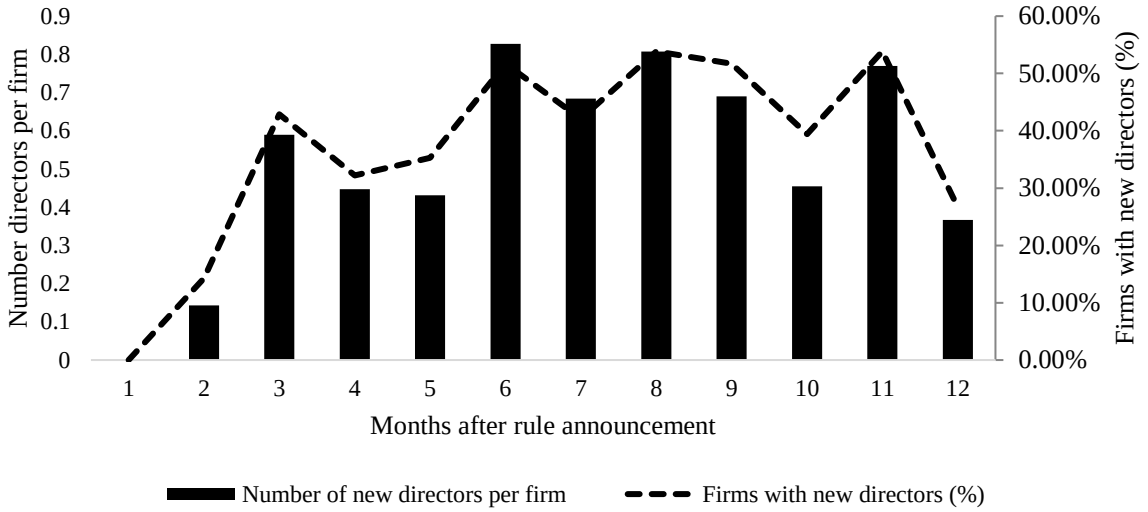


Fig. 4. Proxy filing dates. The figure below examines whether firms in our sample (736 firms) filed their proxies on the same calendar day and month in 2010 relative to their most recent pre-2010 proxy filing date and shows the frequency distribution of the difference between the 2010 proxy statement filing date and the most recent pre-2010 proxy filing date. The vertical axis is the number of proxy statements and the horizontal axis is the difference in days between proxy filing dates. The first number (last number) on the horizontal axis is the frequency of 2010 proxy filings that occurred 31 or more days before (after) the calendar day and month of the most recent pre-2010 proxy filing.

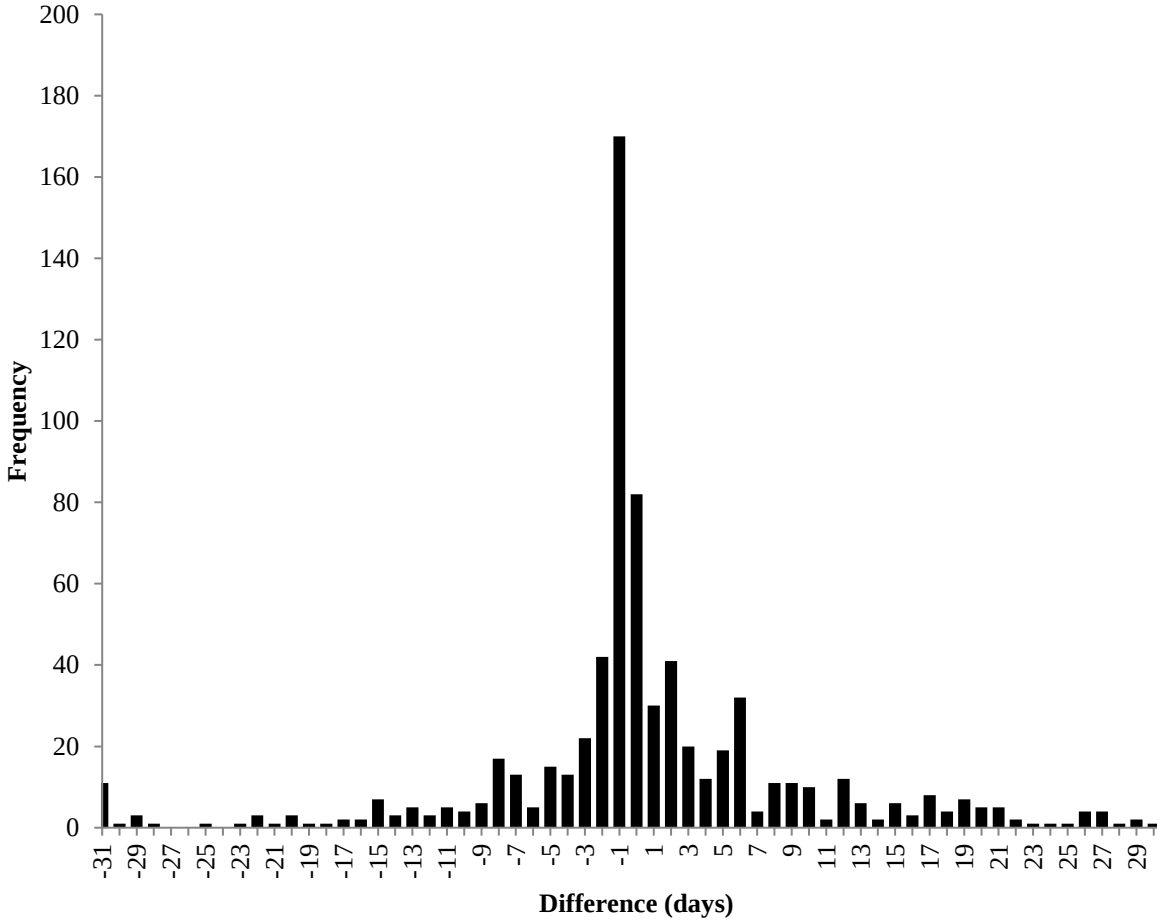


Table 1
Summary statistics

We report summary statistics in this table. Our sample consists of ISS data on U.S. headquartered unregulated non-financial and non-utility firms between 2010 and 2013. The 2009 amendment to Regulation S-K requires public U.S. firms to describe their reasons for nominating directors. Descriptions of directors' skills come from sample firms' proxy statements. Data on board committees and directors' committee memberships are from ISS and BoardEx. Information on whether firms have classified boards is from ISS and director appointment and departure dates are from BoardEx. Financial data are from Compustat. We exclude firm-year observations in which firms did not disclose director skills for two or more directors on their boards and firm-year observations with missing financial or governance data and extreme values of Tobin's *Q*. Variable definitions are provided in Appendix A. Summary statistics for firm characteristics are reported in Panel A and are based on 3,218 firm-year observations between 2010 and 2013. In Panel B, we report director-related statistics. The number of director-year observations for the whole sample is 29,209. Of these, 24,747 are for outside directors (independent or grey) and 4,462 are for inside directors.

Panel A: Firm characteristics

Variables	Mean	Median	Std. dev.	Min.	Max.
Board committees	3.468	3	0.698	1	6
Board independence	0.795	0.818	0.105	0.333	0.941
Board meetings	7.498	7	3.481	2	45
Board size	9.077	9	2.070	3	18
Business segments	2.093	2	1.398	1	9
Capital expenditures	0.056	0.032	0.094	0.001	0.910
CEO age	57.454	57	7.217	33	97
Classified board	0.462	0	0.499	0	1
Firm age	27.646	21	20.105	0	88
Market value of equity (millions of dollars)	11,804	2,439	33,528	56	626,550
Number of skills on the board	10.415	10	2.928	2	20
ROA	0.148	0.139	0.070	-0.044	0.416
Tobin's *Q*	1.924	1.655	0.920	0.837	6.217
Total assets (millions of dollars)	10,863	2,077	37,600	57	751,216
Volatility	0.024	0.021	0.024	0.006	0.602

Panel B: Director and skill characteristics

Variables	Mean	Median	Std. dev.	Min.	Max.
Audit committee member	0.416	0	0.493	0	1
Director age	62.548	63	8.272	27	97
Director tenure	9.081	7	7.753	0	64
Female director	0.135	0	0.342	0	1
Unique skills dummy	0.342	0	0.474	0	1
Unique skills fraction	0.146	0	0.247	0	1
Number of skills (whole sample)	3.067	3	1.710	0	13
Number of skills (outsiders)	3.018	3	1.714	0	13
Number of skills (insiders)	3.334	3	1.662	0	13
Number of unique skills (whole sample)	0.433	0	0.681	0	6
Number of unique skills (outsiders)	0.404	0	0.656	0	6
Number of unique skills (insiders)	0.597	0	0.783	0	6
Number of outside boards	0.875	1	1.023	0	7

Retiring director	0.123	0	0.329	0	1

Table 2
Skill categories

This table lists our 20 skill categories. Data are obtained from 2010–2013 proxy statements. Sample characteristics are provided in Table 1. We code each director's experience, qualifications, attributes, or skills that were important in appointing the director using data from proxy statements.

Variables	Description
Academic	The director is from academia or has a higher degree (such as a Ph.D.).
Company business	The director is experienced in the firm's business or industry (or a closely related industry).
Compensation	The director has compensation and benefits experience.
Entrepreneurial	The director has entrepreneurial experience.
Finance and accounting	The director has experience in banking, finance, accounting, or economics related activities.
Governance	The director has corporate governance experience.
Government and policy	The director has governmental, policy, or regulatory experience.
International	The director has international experience.
Leadership	The director is someone that has leadership skills/experience.
Legal	The director has legal expertise.
Management	The director has management and communications skills/experience.
Manufacturing	The director has manufacturing experience.
Marketing	The director has marketing and sales skills/experience or knowledgeable in marketing activities.
Outside board	The director has outside board experience.
Outside executive	The director is an executive of another company.
Risk management	The director has risk management experience.
Scientific	The director has engineering, scientific, or research & development (R&D) skills/experience.
Strategic planning	The director is someone that has strategy skills or strategy planning experience.
Sustainability	The director has experience in environmental and sustainability issues.
Technology	The director has technology skills/experience.

Table 3
Descriptive statistics

We present various skill- and committee-related descriptive statistics in this table. Data in this table are obtained from 2010–2013 proxy statements and based on 3,218 firm-year and 29,209 director-year observations. In Panel A, we present the means of 20 firm-level skill categories at the director and board levels. The first column is the percentage of directors who have the particular skill. The second and the third columns are the percentages of outside and inside directors who possess the particular skill. The last column is the percentage of boards that have the particular skill. Pairwise correlations between director age and the number of skills and outside directorships and the number of skills that excludes outside directorship as a skill category are reported in Panel B. When computing the correlation between director age and the number of skills, we exclude repeat disclosure of the same set of skills at the director level and only consider the first occurrence. Panel C reports descriptive statistics for committee skill match ratios for 20 committees. To construct the set of committee memberships for all directors, we start with data on compensation, audit, and governance and nominating committee memberships in ISS and supplement it with additional committee memberships from BoardEx. We group committees with similar names in BoardEx. ISS duplicates committees whenever a committee shares tasks. For example, if a firm has one Audit and Compensation committee, ISS will report that the firm has one Audit committee and one Compensation committee with equal membership. This explains why the occurrence of each committee ISS covers is so high in our sample. To find the committee skill match ratio, we first find the number of directors on a particular committee that has the required skills (e.g., the number of directors with compensation skills on the compensation committee). We then compute the ratio of directors with those skills to the number of directors on the committee. We repeat this for all the other committees. In Panel D, we split our director-level sample into two based on whether a firm has an ROA greater than the median ROA in the sample of 3,218 firm-year observations and examine the difference between the number of words used to describe director experience by the ROA subsamples. We report the clarity score in Panel E. Clarity score is a score variable that ranges between zero and one for directors on more than one board that takes into account skills reported by other boards for the same director. We describe the calculation of the clarity score in Section 2.3. Further sample characteristics are provided in Table 1. Values in parentheses in Panel B (Panel D) are *p*-values (*t*-statistics). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Means by skill category

Skill category	Directors			Board
	All	*Outside*	*Inside*	
Academic	0.075	0.081	0.043	0.365
Company business	0.253	0.119	1.000	1.000
Compensation	0.082	0.092	0.022	0.375
Entrepreneurial	0.023	0.025	0.015	0.160
Finance and accounting	0.340	0.373	0.155	1.000
Governance	0.201	0.220	0.095	0.642
Government and policy	0.089	0.099	0.036	0.408
International	0.291	0.306	0.207	0.740
Leadership	0.287	0.274	0.359	0.747
Legal	0.049	0.053	0.025	0.340
Management	0.383	0.385	0.377	0.895
Manufacturing	0.088	0.091	0.077	0.373
Marketing	0.113	0.114	0.107	0.500
Outside board	0.130	0.140	0.076	0.504
Outside executive	0.234	0.214	0.342	0.735
Risk management	0.060	0.066	0.026	0.276
Scientific	0.014	0.014	0.015	0.098
Strategic planning	0.199	0.189	0.251	0.676
Sustainability	0.016	0.017	0.011	0.097
Technology	0.140	0.147	0.101	0.519

Panel B: Correlations

Variables	Number of skills
Director age	0.021**
	(0.041)
Outside directorships	0.072***
	(0.000)

Panel C: Committee skill match ratios

Committee name	N	Mean	Median	Standard deviation	Min.	Max.
Academic	4	0.308	0.292	0.073	0.250	0.400
Audit	3,216	0.552	0.571	0.274	0	1
Company business	103	0.161	0	0.265	0	1
Compensation	3,215	0.152	0	0.260	0	1
Finance	648	0.473	0.500	0.282	0	1
Governance	3,182	0.280	0.200	0.322	0	1
Government	20	0.253	0.250	0.236	0	0.667
International	8	0.875	1	0.173	0.667	1
Leadership	31	0.479	0.333	0.395	0	1
Legal	15	0.217	0	0.364	0	1
Marketing	8	0.604	0.500	0.305	0.250	1
Real estate	3	0.444	0.333	0.192	0.333	0.667
Reserves	11	0.389	0.500	0.299	0	0.800
Risk management	40	0.028	0	0.090	0	0.333
Scientific	90	0.163	0.127	0.188	0	0.667
Securities	10	0.463	0.667	0.319	0	0.667
Strategic planning	152	0.255	0.200	0.277	0	1
Sustainability	291	0.119	0	0.198	0	0.800
Technology	113	0.373	0.333	0.325	0	1
Committee skill match ratio	3,218	0.325	0.310	0.186	0	1

Panel D: Number of words and firm profitability

ROA	N	Mean	Standard deviation
Above the median	14,614	68.086	40.705
Below the median	14,595	64.574	35.257
Difference		3.511***	
t-statistic		(7.869)	

Panel E: Clarity score

Variable	N	Mean	Median	Standard deviation	Min.	Max.
Clarity score	6,948	0.624	0.612	0.116	0.333	1

Table 4
Factor analysis

This table reports the results of factor analysis based on 18 experience categories (we do not use finance and accounting and company business categories as there is no variation, i.e., all boards have at least one director with experience in either finance and accounting or company business). We present unrotated factor loadings on the first four factors using the maximum likelihood method in the first four columns and the iterated principal factor method in the last four columns. Factor loadings less than ｜0.10｜ are set to blank. Sample characteristics are provided in Table 1 and 3.

	Maximum likelihood				Iterated principal factor			
Experience categories	Factor 1	Factor 2	Factor 3	Factor 4	Factor 1	Factor 2	Factor 3	Factor 4
Eigenvalue	1.694	0.653	0.542	0.275	1.745	0.623	0.448	0.271
Percentage explained	53.54	20.65	17.12	8.69	56.55	20.18	14.50	8.77
Academic	0.215		0.129		0.198		0.160	
Compensation	0.394	0.151	-0.313		0.417	-0.187	-0.233	0.120
Entrepreneurial								
Governance	0.432	0.150	-0.331		0.457	-0.207	-0.249	
Government and policy	0.620	-0.451	0.105		0.459	-0.295	0.425	-0.102
International	0.333	0.232	0.279		0.380	0.288		-0.109
Leadership	0.280	0.156			0.319			
Legal	0.186	-0.220	-0.192		0.127	-0.339		
Management	0.237	0.124			0.266			
Manufacturing	0.250	0.284	0.188	-0.124	0.312	0.272		-0.124
Marketing	0.234	0.294		-0.156	0.297	0.220	-0.175	-0.135
Outside board	0.344	0.140		0.309	0.370			0.295
Outside executive	0.155	0.102	0.186	0.285	0.181	0.170	0.148	0.280
Risk management	0.315		-0.118		0.325	-0.112		
Scientific	0.188	0.126	0.176		0.211	0.189		
Strategic planning	0.363	0.173		-0.115	0.399		-0.124	
Sustainability	0.288				0.275		0.126	
Technology	0.162	0.123	0.243		0.184	0.238	0.117	

Table 5

Tobin's *Q*, factor analysis, and the IV regression

We present the results of Tobin's *Q* regressions on the first factors and on the number of skills in this table. The dependent variable is Tobin's *Q* in all models. Factor 1 in the first two columns (Columns 3 and 4) is from the maximum likelihood estimation method (ML) (iterated principal factor method (IPF)). In Column 5 we regress Tobin's *Q* on the number of skills at the board level and add control variables in Column 6. In Column 7, we use the instrumented number of skills and repeat the same model in Column 6 using the two-stage-least-squares method (2SLS) and using only the 2010 data. We report the coefficients from the first-stage on the instruments near the end of Column 7. All variables are defined in Appendix A. Sample characteristics are provided in Table 1. We control for year fixed effects as well as industry effects by including industry dummies based on two-digit SIC codes. *T*-statistics are reported in parentheses below coefficient estimates and are based on heteroskedasticity corrected standard errors. Standard errors are clustered at the firm level. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Variables	ML method		IPF method		Number of skills		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Factor 1	-0.110***	-0.063**	-0.106***	-0.060**			
	(-3.73)	(-2.49)	(-3.55)	(-2.32)			
Number of skills					-0.030***	-0.016**	-0.212*
					(-3.45)	(-2.23)	(-1.83)
Log of total assets		-0.009		-0.011		-0.011	0.020
		(-0.48)		(-0.55)		(-0.59)	(0.58)
ROA		7.973***		7.976***		7.976***	7.349***
		(20.06)		(20.09)		(20.08)	(12.64)
Capital expenditures		-0.105		-0.108		-0.101	-0.725
		(-0.37)		(-0.38)		(-0.35)	(-1.07)
Business segments		-0.028**		-0.028**		-0.028**	0.005
		(-2.19)		(-2.19)		(-2.17)	(0.20)
Log of firm age		-0.087***		-0.086***		-0.086***	-0.098
		(-2.74)		(-2.71)		(-2.69)	(-1.60)
Volatility		0.128		0.118		0.128	1.102
		(0.30)		(0.28)		(0.31)	(1.51)
Board size		-0.007		-0.007		-0.007	0.062
		(-0.60)		(-0.64)		(-0.64)	(1.10)
Board independence		-0.135		-0.134		-0.154	0.603
		(-0.72)		(-0.71)		(-0.82)	(1.31)
Board committees		0.017		0.016		0.015	0.123**
		(0.59)		(0.57)		(0.55)	(1.97)
Board meetings		-0.013***		-0.012***		-0.012***	-0.013
		(-3.05)		(-3.03)		(-3.01)	(-1.64)
CEO age		-0.009***		-0.009***		-0.009***	-0.019***

		(-3.00)		(-3.02)		(-3.01)	(-3.26)
Constant	1.889***	1.825***	1.887***	1.841***	2.195***	2.026***	2.646***
	(60.45)	(7.20)	(60.31)	(7.23)	(23.51)	(8.04)	(4.16)
1st stage – time since announcement							0.003**
							(2.17)
1st stage – airport proximity dummy							2.218***
							(3.04)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted *R*-squared	0.132	0.471	0.131	0.471	0.130	0.471	0.183
N	3,218	3,218	3,218	3,218	3,218	3,218	736

Table 6
Tobin's *Q* and common ground

We report summary statistics for the common ground proxies in Panels A and B, and the results of regressions that show how the common ground proxies are related to Tobin's *Q* in Panel C. Our first common ground proxy is the Blau score. The Blau score is our measure of concentration of skills among directors and calculated as $1 - \Sigma p_i^2$ (Blau, 1977). By construction, the Blau index is between zero and (K – 1)/K where K is the maximum number of skills, which in our case provides a theoretical maximum of 19/20. A high Blau score indicates a low concentration of skills among directors, and thus low levels of common ground. Our second common ground proxy is the inside-outside Blau score. This measure is calculated similar to the Blau score by treating inside and outside directors as separate groups. The numbers in parentheses underneath the correlations in Panel B are *p*-values. Factor 1 (ML) (Factor 1 (IPF)) is the factor from the maximum likelihood estimation method (iterated principal factor method). Number of skills is the number of skills represented on the board. The dependent variable in Panel C is Tobin's *Q* in all models. All variables are defined in Appendix A. Sample characteristics are provided in Table 1. We control for year fixed effects as well as industry effects by including industry dummies based on two-digit SIC codes. *T*-statistics are reported in parentheses below coefficient estimates in Panel C and are based on heteroskedasticity corrected standard errors. Standard errors are clustered at the firm level. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Summary statistics

Variables	Mean	Median	Standard deviation	Min.	Max.
Blau score	0.853	0.867	0.055	0.142	0.931
Inside-outside Blau score	0.884	0.893	0.042	0.444	0.944

Panel B: Correlations

Variables	Factor 1 (ML)	Factor 1 (IPF)	Number of skills
Blau score	0.727***	0.785***	0.809***
	(0.000)	(0.000)	(0.000)
Inside-outside Blau score	0.804***	0.859***	0.891**
	(0.000)	(0.000)	(0.000)

Panel C: Regressions

	Blau		Inside-outside Blau	
Variables	(1)	(2)	(3)	(4)
Blau	-1.256**	-0.729*		
	(-2.51)	(-1.96)		
Inside-outside Blau			-1.799***	-0.778
			(-2.74)	(-1.47)
Log of total assets		-0.013		-0.012
		(-0.66)		(-0.65)
ROA		7.975***		7.977***
		(20.05)		(20.02)
Capital expenditures		-0.117		-0.107
		(-0.41)		(-0.37)
Business segments		-0.028**		-0.028**
		(-2.20)		(-2.19)
Log of firm age		-0.087***		-0.088***
		(-2.74)		(-2.76)

Volatility		0.101		0.127
		(0.24)		(0.30)
Board size		-0.012		-0.010
		(-1.04)		(-0.89)
Board independence		-0.166		-0.159
		(-0.89)		(-0.84)
Board committees		0.014		0.013
		(0.49)		(0.45)
Board meetings		-0.012***		-0.012***
		(-3.03)		(-2.99)
CEO age		-0.009***		-0.009***
		(-3.00)		(-2.97)
Constant	2.962***	2.553***	3.479***	2.599***
	(6.94)	(6.58)	(6.01)	(5.34)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted *R*-squared	0.128	0.471	0.128	0.470
N	3,218	3,218	3,218	3,218

Table 7
Market reaction

We present the market's reaction to director departures and additions in this table. We estimate the abnormal returns over a five-day window (-2, +2) using the market model benchmark returns with the CRSP value-weighted index returns. The parameters for the market model are estimated over the (−255, −46) period relative to the announcement date. In calculating the abnormal returns for departing directors, we eliminate a departure from the analysis if there are multiple director departure announcements on the same day, if the director is 72 or above, and if the director departure announcement is first reported in the proxy statement. For joining directors, we have the same filters except that we do not impose an age restriction on them. We also eliminate extreme cumulative abnormal returns from the analysis based on the 1st and 99th percentiles. Only director departures and additions between 2010 and 2012 are used in the analysis below. There are 343 departing directors and 618 joining directors in our sample. CARs for the whole sample are in Panel A. We split the sample into two based on whether the director has any unique skills in Panel B. In Panel C, we divide the sample into two based on whether the number of skills the director has is more than the sample median (based on 29,209 director-years). In Panel D, we split the sample based on whether the director is departing from or joining a firm whose Blau is less or more than the median Blau of the sample (3,218 firm-years). *P*-values for the mean and median in Panel A are based on the one-sample t-test and one-sample median test, respectively. *P*-values for the differences are based on the two-independent sample *t*-test for the means and Wilcoxon-Mann Whitney test for the medians. * indicates statistical significance at the 10% level.

		Departing directors			Joining directors		
Subsample		N	Mean	Median	N	Mean	Median
Panel A: Whole sample							
CAR (%)		343	-0.122	-0.146	618	0.164	0.090
p-value			(0.617)	(0.732)		(0.387)	(0.479)
Panel B: Unique skills dummy							
CAR (%)	No unique skills	241	-0.409	-0.428	421	0.061	0.104
CAR (%)	At least one unique skill	102	0.555	0.359	197	0.385	0.041
Difference			-0.964*	-0.788*		-0.324	0.063
p-value			(0.071)	(0.095)		(0.426)	(0.933)
Panel C: Number of skills							
CAR (%)	Less than the median	147	-0.588	-0.600	264	0.149	0.196
CAR (%)	Greater than the median	196	0.227	0.058	354	0.175	0.049
Difference			-0.815*	-0.658		-0.026	0.147
p-value			(0.098)	(0.325)		(0.945)	(0.710)

Panel D: Blau							
CAR (%)	Less than the median	156	-0.286	-0.466	266	0.096	-0.071
CAR (%)	Greater than the median	187	0.014	-0.097	352	0.215	0.199
Difference			-0.300	-0.368		-0.119	-0.270
p-value			(0.541)	(0.970)		(0.757)	(0.533)

Table 8

Unique skills and board changes

In this table, we examine the relationship between unique skills and board changes. In Panel A, we examine how having a unique skill affects the likelihood of leaving the board. The dependent variable is a dummy variable equal to one if the director leaves the firm during the year and zero otherwise. All models are estimated using OLS and only director departures between 2010 and 2012 are used in the analysis. We have 1,478 departing directors between 2010 and 2012. Additionally, newly joined directors are excluded from the analysis (for example, a director who joins a firm in 2010 is excluded from the analysis in 2010 but included in the remaining years). Directors with missing skill descriptions are also excluded from the analysis. All variables are defined in Appendix A. We control for year and firm fixed effects in all models. *T*-statistics are reported in parentheses below coefficient estimates and are based on heteroskedasticity corrected standard errors. Standard errors are clustered at the firm level. In Panel B, we report the means for the skills of directors who leave or join a board in a given year between 2010 and 2012. To create our sample of paired director departures and additions, we require that the number of departures and additions must be the same during the year for a firm. Thus, we implicitly assume that any new directors replace the departing directors. Departures also include retiring directors. We then determine departing and joining directors' number of unique skills and their total number of skills. There are 275 departing and joining directors that we were able to pair using our procedure between 2010 and 2012. The first two rows of the panel are for the full sample of 275 pairs. We then split the sample based on the median Blau score in the next four rows and report the same statistics for these subsamples. We test the statistical significance of the difference between the two means using a paired-*t*-test. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Unique skills and director departures

Variables	(1)	(2)	(3)	(4)
Blau	-0.244	-0.291*	-0.311*	-0.273
	(-1.45)	(-1.71)	(-1.82)	(-1.59)
Unique skills		-0.140***		
		(-2.97)		
Blau * Unique skills		0.157***		
		(2.87)		
Unique skills dummy			-0.213***	
			(-3.60)	
Blau * Unique skills dummy			0.241***	
			(3.48)	
Unique skills fraction				-0.181
				(-1.53)
Blau * Unique skills fraction				0.198
				(1.42)

Independent director	-0.013**	-0.014***	-0.014***	-0.013**
	(-2.43)	(-2.66)	(-2.65)	(-2.53)
Female director	-0.006	-0.006	-0.006	-0.006
	(-1.26)	(-1.19)	(-1.22)	(-1.22)
Outside boards	-0.002	-0.002	-0.002	-0.002
	(-1.31)	(-1.29)	(-1.29)	(-1.32)
Director tenure	0.001***	0.001***	0.001***	0.001***
	(2.97)	(2.89)	(2.89)	(2.93)
Retiring director	0.145***	0.146***	0.146***	0.146***
	(14.33)	(14.36)	(14.35)	(14.38)
Audit committee	-0.017***	-0.017***	-0.017***	-0.017***
	(-4.42)	(-4.47)	(-4.46)	(-4.48)
Board size	0.041***	0.041***	0.041***	0.041***
	(10.14)	(10.08)	(10.07)	(10.08)
Classified board	0.005	0.005	0.005	0.005
	(0.34)	(0.33)	(0.34)	(0.33)
Log of total assets	-0.062***	-0.061***	-0.062***	-0.062***
	(-2.62)	(-2.61)	(-2.62)	(-2.62)
ROA	-0.138	-0.138	-0.139	-0.138
	(-1.43)	(-1.44)	(-1.44)	(-1.44)
Constant	0.381	0.426*	0.444*	0.410*
	(1.55)	(1.73)	(1.81)	(1.66)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Adjusted *R*-squared	0.067	0.067	0.067	0.067
N	21,635	21,635	21,635	21,635

Panel B: Paired sample of director departures and additions

	Departing directors		Joining directors	
Variables	N	Mean	N	Mean
Unique skills	275	0.418**	275	0.302
Number of skills	275	3.055	275	3.036
Blau (greater than the median)				
Unique skills	152	0.428	152	0.322
Number of skills	152	3.513	152	3.434
Blau (less than the median)				
Unique skills	123	0.407	123	0.276
Number of skills	123	2.488	123	2.545